

On the Influence of Physico-Chemical Agencies upon the Development of the Tadpoles of Rana esculenta. By M. EMILE YUNG.

The author subjected tadpoles just hatched to the action of saline solutions of various strengths. The salts employed were obtained by the evaporation of the water of the Mediterranean, and the larvæ were placed in solutions of 1, 3, 5, 7, and 9 per 1000, which were renewed at the same time in all the vessels, and the whole were in other respects placed under precisely the same conditions. As a general result, M. Yung states that *the tadpoles are developed the more slowly the more considerable the degree of saltiness of the water.* In the solution of $\frac{9}{1000}$ no transformation took place, though some tadpoles lived long enough to acquire hind limbs. In a solution of $\frac{10}{1000}$ very young tadpoles die in a few hours; older ones survive for a few days.

The author remarks upon the importance of placing *equal numbers* of individuals in each vessel in experiments of this kind. On placing 4, 8, 12, 16, &c. tadpoles of the same age and the same brood in a series of vessels, and keeping them under precisely the same conditions, *their development is found to be slower in proportion to the number living together*, which confirms the results obtained by Semper for the *Limnææ*.

Finally, M. Yung subjected young tadpoles, which normally live in quiet water, to continuous agitation in a vessel containing two litres of water regularly renewed and suitable food. The agitation of the liquid was felt to the bottom of the vessel, but reached its maximum at the surface, where the tadpoles, on coming up to the air, had to struggle against strong waves. Under these conditions the eggs developed well; but the newly hatched tadpoles, being too feeble to seize their prey in so disturbed a medium, died of hunger, unless care was taken to give them daily a few moments of repose to take their food. The mortality was always greatest in the first few days; it diminished immediately the first transformations were effected. Of twenty individuals placed in the vessel in April, eight have furnished little frogs, and on the 1st August only one had not completed its metamorphoses.

If these agitated tadpoles be compared, at different periods, with others of the same brood developing in quiet water, *it is found that the development of the former is slower* (the test-tadpoles were all transformed on the 15th July), *that they are less pigmented*, which indicates bad nutrition (the tadpoles which do not eat much are always pale); and, lastly, *that their tails are relatively more developed, especially in width*, which is explained by the greater use they are obliged to make of these organs in struggling against the waves.—*Bibl. Univ., Arch. des Sciences*, pér. 3, tome x. p. 347, October 15, 1883.